

# Computed Tomographic Identification of Congenital Right L5 Pedicle Agenesis with Vertebral Body–Based Ectopic Transverse Process

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## ABSTRACT

Congenital agenesis of a lumbar vertebral pedicle is an exceptionally rare developmental anomaly that is often detected incidentally during imaging performed for unrelated clinical indications. Although most cases remain asymptomatic, accurate recognition is essential to prevent misinterpretation as traumatic, infectious, or neoplastic pathology and to avoid potential complications during spinal interventions. We report an incidental finding of unilateral right L5 pedicle agenesis in a 42-year-old woman who underwent contrast-enhanced computed tomography of the abdomen for evaluation of abdominal pain and loose stools. Abdominal findings were unremarkable; however, axial and multiplanar reformatted images revealed complete absence of the right pedicle of the L5 vertebra. The right transverse process was anomalously positioned, arising directly from the vertebral body rather than from the pedicle, representing a rare anatomical variant. The vertebral body, posterior elements, and neural arch were otherwise intact, with no evidence of spondylolisthesis, spinal canal compromise, nerve root compression, or adjacent degenerative changes. The patient had no history of back pain, radiculopathy, neurological deficits, or prior spinal disease. Imaging features were consistent with a benign congenital anomaly rather than an acquired destructive process. This case highlights a rare lumbar spine variant and underscores the importance of recognizing congenital pedicle agenesis and associated osseous alterations on CT imaging. Awareness of such entities is crucial for radiologists and spine surgeons to avoid diagnostic errors, unnecessary investigations, and inadvertent complications during surgical planning or spinal instrumentation.

**Keywords:** Pedicle agenesis; Congenital spinal anomaly; Lumbar spine; Computed tomography; Surgical planning

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## INTRODUCTION

Congenital anomalies of the vertebral column represent a heterogeneous group of developmental disorders that may involve the vertebral body, neural arch, or posterior elements. Among these, congenital absence (agenesis) of a vertebral pedicle is exceptionally rare, particularly in the lumbar spine. Most reported cases involve the cervical or thoracic regions, with lumbar pedicle agenesis being considerably less common. When present, the anomaly is typically unilateral and frequently detected incidentally during imaging performed for unrelated clinical indications [1].

The clinical relevance of pedicle agenesis lies not in its symptomatic burden—which is often minimal—but in its potential to mimic pathological conditions such as traumatic fractures, osteolytic lesions, infections, or neoplasms on conventional radiography [2]. Misinterpretation may lead to unnecessary diagnostic workup or inappropriate surgical intervention. Cross-sectional imaging, particularly computed tomography (CT), plays a pivotal role in distinguishing this benign congenital variant from acquired destructive processes [3].

From a surgical perspective, the pedicle is a critical anatomical structure, serving as the primary anchoring point for spinal instrumentation and a key landmark for

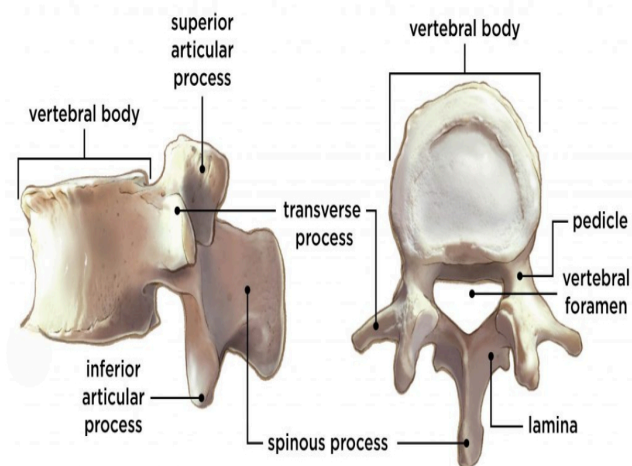
nerve-root orientation. Failure to recognize pedicle agenesis preoperatively can result in catastrophic complications, including screw misplacement, neural injury, or biomechanical instability [4]. Therefore, awareness of this anomaly and its imaging characteristics is essential for radiologists, orthopedic surgeons, and neurosurgeons alike. We report a rare incidental case of unilateral right L5 pedicle agenesis with an ectopic transverse process arising directly from the vertebral body, identified on abdominal CT in an otherwise asymptomatic adult female. The case underscores the importance of recognizing this rare congenital variant and highlights its embryological basis, imaging features, and clinical implications.

## CASE PRESENTATION

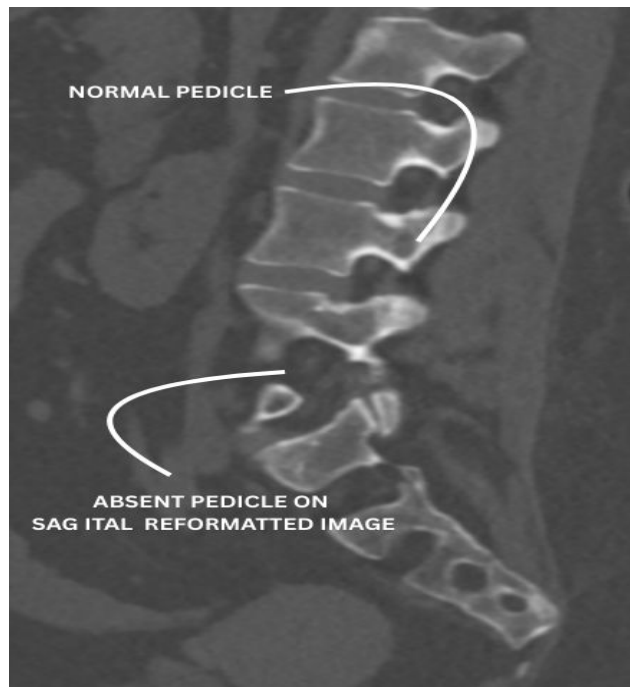
A 42-year-old female presented to the outpatient clinic with a several-week history of diffuse, non-specific abdominal pain and loose stools. Her medical history was unremarkable, and she reported no chronic back pain, radicular symptoms, lower extremity weakness, or prior history of significant trauma or spinal surgery. A physical examination revealed no neurological deficits; motor strength, sensation, and deep tendon reflexes in the lower limbs were normal.

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As part of her diagnostic workup, a contrast-enhanced multidetector CT scan of the abdomen and pelvis was performed to evaluate visceral pathology. The abdominal and pelvic components of the study were within normal limits. However, the included portions of the lumbar spine demonstrated an incidental but striking osseous anomaly at the L5 level (Figure 1).

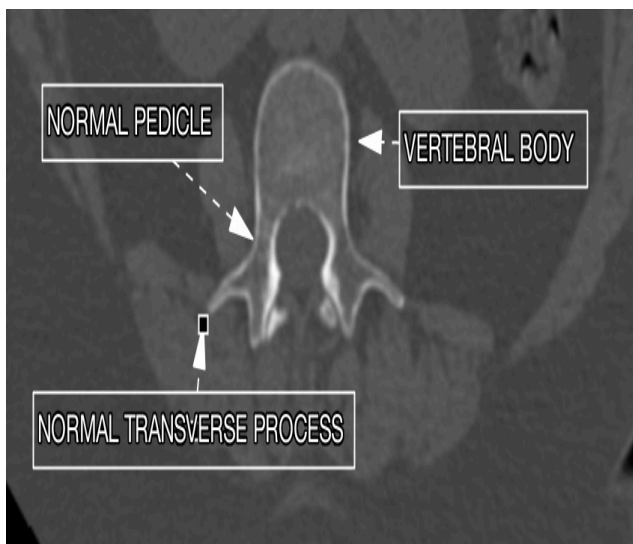


**Figure 1A: Normal vertebral anatomy illustrating the vertebral body, superior and inferior articular processes, transverse process, pedicle, lamina, and spinous process.**



**Figure 2: Axial CT image shows an absent right pedicle of lumbar vertebral body with a normal left pedicle labelled**

The defect was well-defined with smooth, sclerotic margins, indicative of a long-standing, non-aggressive process rather than an acute fracture or destructive lesion. The most notable associated finding was the origin of the right L5 transverse process, which arose not from the expected junction of the missing pedicle and lamina, but directly from the right lateral aspect of the L5 vertebral body itself (Figures 3 & 4).



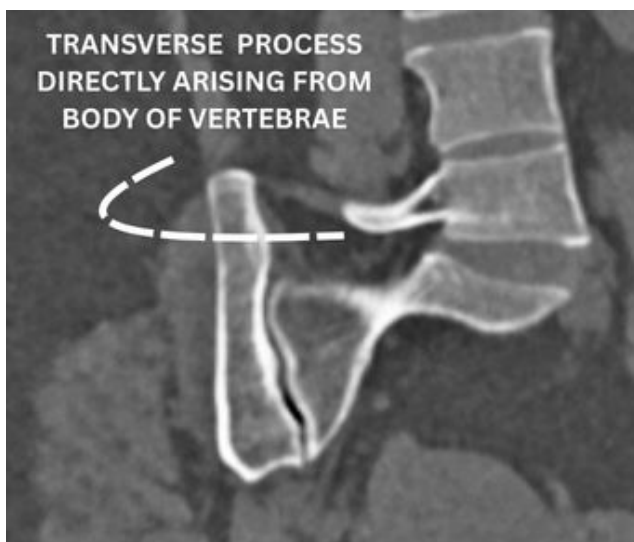
**Figure 1B: Axial CT image of a normal lumbar vertebra showing the vertebral body, pedicle, and transverse process clearly labelled**



**Figure 3: Sagittal MPR reformatted image of lumbar vertebrae right side showing absent pedicle at L5 and normal pedicle labelled**

This prompted a dedicated retrospective analysis of the spinal anatomy using the available thin-slice CT data with multiplanar reconstructions (MPR).

The imaging evaluation revealed complete absence of the right L5 pedicle (Figure 2).



**Figure 4: Coronal CT MPR reformatted image showing the right transverse process arising directly from the lateral aspect L5 vertebral body due to pedicle agenesis**



**Figure 5: Axial CT at lumbar spine showing the right transverse process directly arising from the lateral aspect of right side of lumbar vertebral body labelled**

This ectopic transverse process appeared otherwise normal in morphology. The contralateral (left) L5 pedicle, lamina, and transverse process were normal in appearance. The spinal canal was patent, and the neural foramina showed no significant stenosis. No spondylolysis or spondylolisthesis was present. The adjacent vertebral bodies and intervertebral discs were unremarkable. The constellation of findings—a corticated pedicular defect with an ectopic, vertebrally-attached transverse process and absence of soft tissue mass or bone edema—was pathognomonic for congenital pedicle agenesis. The patient was informed of the incidental finding, and in light of her complete lack of spinal symptoms, no further intervention or imaging was warranted.

#### DISCUSSION

Congenital pedicle agenesis is an uncommon developmental anomaly resulting from failure of ossification of the neural arch during embryogenesis. The vertebral pedicles arise from chondrification centers of the neural arch, derived from sclerotomal mesenchyme. Disruption of this process either due to failure of dorsal

migration or defective ossification, results in absent pedicle formation [3,5,6]. The associated redirection of growth forces may lead to compensatory or ectopic development of adjacent structures, including transverse processes arising directly from the vertebral body, as demonstrated in the present case.

Radiographically, pedicle agenesis can closely resemble destructive lesions, particularly on plain radiographs, where it may present as a “missing pedicle” sign. Historically, this sign has been associated with metastatic disease, infection, or trauma, often prompting extensive diagnostic workup [7]. CT imaging is therefore indispensable, as congenital agenesis demonstrates smooth, corticated margins, absence of bone destruction, lack of surrounding sclerosis or soft-tissue mass, and preservation of adjacent vertebral structures [8]. Magnetic resonance imaging may further confirm the benign nature by demonstrating absence of marrow edema or inflammatory changes.

Lumbar pedicle agenesis is particularly rare compared with cervical cases. When present, it is most commonly unilateral and frequently asymptomatic [9]. Symptoms, when they occur, are usually attributable to secondary degenerative changes, altered biomechanics, or contralateral facet overload rather than the anomaly itself. In the present case, the patient remained entirely asymptomatic, highlighting the incidental nature of this variant.

The surgical implications of pedicle agenesis are substantial. Pedicle-based fixation on the affected side is not feasible, and altered anatomy may obscure normal nerve-root trajectories [10]. Unrecognized pedicle absence increases the risk of screw misplacement, dural breach, or neural injury. Alternative fixation strategies including laminar screws, cortical bone trajectory screws, transverse process hooks, or extension to adjacent levels may be required [11]. Preoperative recognition is therefore critical to surgical planning and risk mitigation.

The ectopic origin of the transverse process from the vertebral body, as observed in this case, further emphasizes the adaptive nature of skeletal development in the setting of congenital anomalies. Such variants are rarely described in the literature and add to the spectrum of morphological alterations associated with pedicle agenesis.

This case reinforces the importance of meticulous image review, even on studies performed for non-spinal indications. Radiologists should explicitly describe congenital anomalies and clearly distinguish them from pathological entities to prevent misdiagnosis and unnecessary intervention.

#### CONCLUSION

This report describes a rare incidental finding of unilateral right L5 pedicle agenesis with a vertebral body–based ectopic transverse process in an asymptomatic adult female. Although typically benign and clinically silent, this congenital anomaly carries significant diagnostic and surgical relevance. Accurate recognition on CT imaging is essential to differentiate it from destructive spinal pathology and to inform safe surgical planning should spinal intervention ever be required. Increased awareness

among radiologists and spine surgeons can prevent diagnostic errors, avoid unnecessary procedures, and reduce the risk of intraoperative complications

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